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Ichneumoninae Stenopneusticae of raised bog, with special reference to long term dynamics (Hymenoptera, Ichneumonidae)

A.M. TERESHKIN

Abstract: A total of 134 species of Ichneumoninae Stenopneusticae were recorded on raised bog (Pinetum sphagnosum). 102 of them are characteristic for this ecosystem. The problems of the Ichneumoninae St.-species composition, exposure, phenology, dynamics of dominance structure and spatial distribution of species are examined. Most species and individuals were recorded in June. The dominance structure was not stable during the 9-years period of observations. Investigation of the factors determining or influencing the long term dynamics of Ichneumoninae showed a possible influence of winter climatic factors on the Ichneumoninae long term dynamics trend. Minimum Ichneumoninae abundance was preceded by cold winters and late springs, and a maximum one was observed in the years with warmer winters. The analyses of the material showed that a possible reason explaining this dynamic is a poor adaptation to the unfavourable winter conditions of Ichneumoninae hibernating at preimaginal stages of development.

Introduction

There are some preconditions which cause investigations directed on the fauna and ecology of Ichneumonidae of raised bogs. On one side, it is necessary to complete the exploration of the raised bogs in this aspect and on the other side it is the highest stability of raised bogs among natural ecosystems. The practically complete absence of successional changes over long periods of time makes its possible to reveal necessary criteria for the estimation of the Ichneumonidae's community structure which is characteristic for different ecosystems. It is necessary to differentiate between successional factors and those caused by anthropogenic influences. It was our motive to conduct long term investigations with the aim of determining parameters needed for comparative ecological investigations of different ecosystems as well as investigating the causes determining or influencing the long term dynamics of Ichneumonidae.

The hymenopterous fauna of the raised bog was studied by Dr. V. HAESELER (1987) in Northern Germany. But his investigations concerned Aculeata only.

Study area, methods and material

The study was carried out on the territory of the absolutely protected zone of the Beresina Biosphere Reserve (1986-1994) and Pripyat National Reserve (1987, 1993). Main results derive from the Beresina Biosphere Reserve. The study of Ichneumonidae on the Pripyat National Reserve territory was carried out during two seasons to get comparative results.

Investigations were carried out on one of the biggest bog massives of the Beresina Biosphere Reserve with total area of 3086 hectares. The ecosystem studied is a bog moss pine forest (Pinetum sphagnosum) with an average depth of peat 2.7 m and height of a stand of about 3 m. The living soil cover is characterised by the following indices: *Ledum palustre* L. -5 %, *Vaccinium uliginosum* L. - 5 %, *Cassandra callyculata* L. - 15 %, *Andromeda polifolia* L. - 10 %, *Oxycoccus quadripetalus* GILB. - 5 %, *Sphagnum* spp. - 60 %. These indices were different on the border of the massive and in the environments of the bog's lake accordingly.

Fig. 1: Malaise trap on the raised bog

The investigations were carried out with help of Malaise traps modificated by Townes (TOWNES 1972, TERESHKIN & SHLYAKHTYONOK 1989) which were placed at the end of April or beginning of May and dismantled in October (fig. 1). Test selection were made at two weeks - one month intervals depending upon the tasks of a concrete season. One to eight traps were used in different years.

When studying the distribution of ichneumon flies in stands, the traps were placed along the profile of stand from the border to the central part taking into consideration its heterogeneity (ecotonic places, cuttings, lakes and so on). Using this method during the whole 9-years period over 44 thousand of Ichneumonidae were collected, 8,349 from them - Ichneumoninae Stenopneusticae.

Structure of Ichneumonidae community

Analysis of the material obtained by 8 Malaise traps during a 10 days' period showed the following quantitative ratio of different orders of insects: Ephemeroptera - 2, Odonatoptera - 3, Blattoptera - 3, Plecoptera - 35, Psocoptera - 17, Hemiptera - 5, Homoptera - 24, Coleoptera - 613, Neuroptera - 55, Raphidioptera - 4, Trichoptera - 114, Lepidoptera - 640, Diptera - 8166, Hymenoptera - 2567. It is obvious that Malaise traps catch a great number of active flying groups - Lepidoptera, Hymenoptera and Diptera. 92.5 % of all insects caught are out of these orders. Apocrita make 95.6 % of all Hymenoptera. They were presented by the following ratio of different systematic groups: Chrysididae - 4 (0.1 %), Pompilidae - 7 (0.3 %), Vespidae - 18 (0.7 %), Eumenidae - 1 (0.04 %), Sphecidae - 55 (2.2 %), Apidae - 69 (2.8 %), Formicidae - 102 (4.1 %), Proctotrupoidea + Ceraphronoidea - 50 (2 %), Braconidae - 368 (15 %) and Ichneumonidae - 1629 (66.3 %). Thus, Ichneumoninae made the largest part of Apocrita caught by Malaise traps. An analogous ratio was observed by us in other ecosystems, too (TERESHKIN & SHLYAKHTYONOK 1989). This ratio only defines the suitability of the method for studying a concrete group of insects.

At the same time we conducted a test selection by menace of yellow pan traps placed near the Malaise traps. The data obtained showed a different ratio of hymenopterous' groups though in this case Ichneumonidae took the first rank and made up to 34.5 % of all Apocrita collected.

On the raised bogs, Ichneumonidae were presented by 18 subfamilies among which Campopleginae, Ichneumoninae and Cryptinae are dominant, each of which makes up over 20 % of all the quantity of Ichneumonidae. During a long period of time we conducted a comparative study of the structure of the Ichneumonidae complex in different ecosystems. It was established that Ichneumoninae St. were mostly presented in a maximum abundance on raised bogs. They take the leading rank of abundance among subfamilies of Ichneumonidae. The ratio of Ichneumonidae's subfamilies on raised bogs of Beresina and Pripyat National Reserves is presented on figure 2.

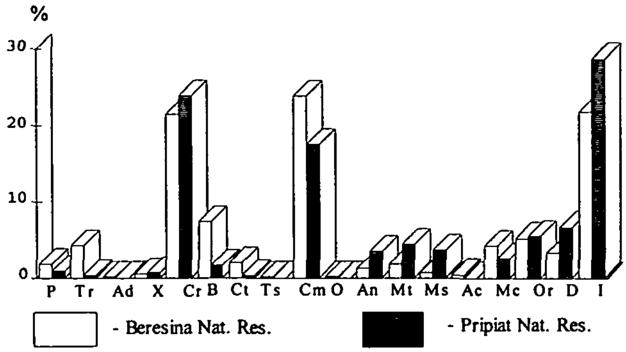

Fig. 2: The ratio of subfamilies of Ichneumonidae of the raised bog: P - Pimplinae; Tr - Triphoninae; Ad - Adelognatinae; X - Xoridinae; Cr - Cryptinae; B - Banchinae; Ct - Ctenopelmatinae; Ts - Tersilochinae; Cm - Campopleginae; O - Ophioninae; An - Anomaloninae; Mt - Metopiinae; Ms - Mesochorinae; Ac - Acaenitinae; Mc - Microleptinae; Or - Orthocentrinae; D - Diplazontinae; I - Ichneumoninae

One can see, that on the raised bog of Beresina National Reserve Ichneumoninae St. occupies the second rank of abundance following the representatives of Campopleginae subfamily and it maked only 2 %. It should be mentioned that on the figure the total of many years' data is presented. During many years Ichneumoninae dominated among Ichneumonidae subfamilies and only in some years representatives of Campopleginae occupied the first rank because of intensive flying and many times they left behind all the other groups concerning quantity. Nevertheless, the coefficients of correlation between curves reflecting Ichneumonidae's community structure varied in different years from 0.8 to 0.95. i.e., the quantitative ratio of subfamilies is a rather stable index characterising Ichneumonidae's community within a concrete ecosystem.

Ichneumoninae Stenopneusticae species composition

Investigations over many years at stationary sites in a concrete ecosystem showed that long time observations are needed for obtaining the most complete set of species composition. From figure 3 it is obvious that the full set of species composition of Ichneumoninae St. was observed only in 1993, after 8 years of continuous observations.

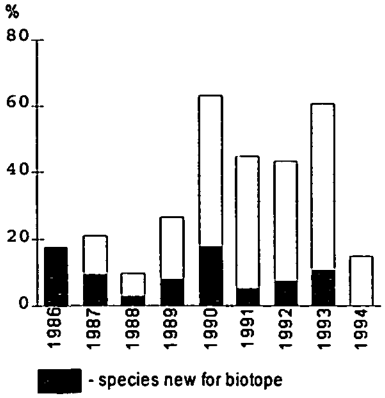

Fig. 3: Dynamics of species composition

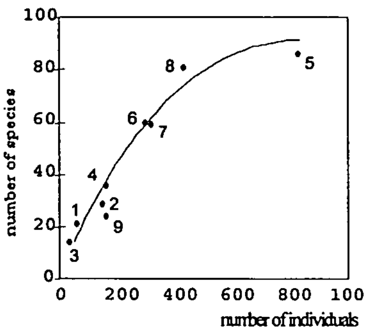

Fig. 4: Dependence of species registered number upon abundance of Ichneumoninae St. in different years; 1 - 1986; 2 - 1987; 3 - 1988; 4 - 1989; 5 - 1990; 6 - 1991; 7 - 1992; 8 - 1993; 9 -1994

In the next year (1994), there was not any registration of a new species for the ecosystem under study. At the same time the number of species caught during the season was not determined by the number of Malaise traps mainly, but mostly it depended on long term fluctuations of ichneumon flies (see below).

The number of species recorded in a concrete season varied from 13 to 87. The maximum total number of species and species new for biogeocoenosis was recorded in 1990. In this season the maximum abundance of Ichneumoninae was recorded aswell. The curve reflecting the dependence of the recorded species' number on abundance in different years has an exponential character and is restricted by the upper limit equal to the number of species in the ecosystem (fig. 4).

Ichneumoninae Stenopneusticae of the raised bog are represented by 134 species which are distributed among the tribes Platylabini (9), Clypeodromini (1), Listrodromini (2), Joppocryptini (1), Ichneumonini (107), Protichneumonini (12) and Trogini (1 species). The representatives of 41 genera from 89 of Ichneumoninae St. known for Western Europe fauna were registered. The long term study of the raised bog Ichneumoninae allowed to present some interesting results. On the basis of collected material the monotypic tribe Clypeodromini occupying an intermediate position between Platylabini and Listrodromini and a male of *Coelichneumon multicolor* THOMS. were firstly described (TERESHKIN 1991, 1992). Of special interest is a species of *Ichneumon* with a red metanotum - *Ichneumon alpestriops* HEINRICH, *I. emancipatops* HEINRICH and *I. connectens* ROMAN which have an arctic or arcto-alpine distribution (HEINRICH 1951, HILPERT 1992). In our region they were not found in any other ecosystems. One more interesting fact, is that a species like *Coelichneumon*

nigerrimus STEPH. which is poorly represented in European collections became a dominant species (16.2 %).

Biological peculiarities of Ichneumoninae St. of the raised bog are presented by such groups. 27 species are caterpiller-pupal parasites. There are mainly representatives of the tribes Platylabini, Clypeodromini, Listrodromini, Trogini and subtribe Amblytelina. By abundance they constitute only to 3.3 % of the whole number of the collected Ichneumoninae St. 107 species and 96.7 % of the total number are pupal parasites. 66 species and only 23 % of the total number are Ichneumoninae St. hibernating at imago stage. The overwhelming majority of the total number of the collected species (77.6 %) is a nonhibernating species. They are presented in the raised bog's fauna by 68 species.

Taxonomic notes

Analysing the material it was found that some species could not be identified. Most probably all of them are of a new status. This concerns primarily the representatives of the *Barichneumon* genus *praeceptor* group, the males of which differ sharply by the form of tyloides. One of the most abundand and typical raised bog species - *Coelichneumon haemorrhoidalis* GRAV. is ideally for the description of females. At the same time the peculiarities of males' colour such as clearly defined annulus, white scutellum, white annulus on the hind tibia and widely distributed white coloration of the pronotum are not typical for representatives of this species. It is possible that further analysis of the material will indicate a new status of the species. At the same time it should be mentioned that a more distributed white coloration of specimens from raised bog is peculiar for another species (*Coelichneumon sugillatorius* L., males *Barichneumon*). It was shown by the study that white coloration of *Coelichneumon multicolor* GMEL. males' scutellum varies from absolutely white to two very small spots on the apex (TERESHKIN 1991). Therefore it is quite possible that this parameter correlates with ecological peculiarities of the ecosystem.

One of the main problem of determination is the impossibility to carry out reliable identification of the males of *Ichneumon* genus at the present stage. Therefore data about seasonal dynamics of *Ichneumon* females only are presented in the table. Data about the seasonal dynamic of males are presented in total without an indication of species.

Seasonal dynamics of flying

On table 1 and figure 5 nine-years data of Ichneumoninae St. seasonal dynamics are presented in total. One can see that the highest quantity of species and their abundance are recorded in June. 87 of 134 or 65 % of the total number of all species found in the ecosystem are recorded in this month. In June the maximum species number of the Protichneumonini tribe (12) owing to the representatives of genus *Coelichneumon* and subtribe Cratichneumonina (39 species) are recorded. The maximum number of the Ichneumoninae subtribe (34) was recorded in May, mainly because of the intensive flying of overwintered females of the genus *Ichneumon*. The quantitative ratio of different Ichneumoninae St.'s groups within a season is presented on figure 5. One can see, that in June the major number of both representatives of Ichneumonini tribe (subtribe Cratichneumonina) and Protichneumonini are caught. However, representatives of the Amblytelina subtribe reach their maximum abundance at the end of summer season. At the same period species of the Ichneumonina subtribe reach their peak of abundance because of intensive flying of males of the *Ichneumon* genus. During the flying periods species of Ichneumoninae St. are distributed in the following way: springtime - 11 single-noted species, spring-summer - 50, summer -54, summer-autumn - 6 and spring-summer-autumn - 13 species. Only one species - *Chasmias lugens* - was registered only in spring and autumn. Most representatives with low abundance of Platylabini tribe were recorded as summer type (6), the tribes Listrodromini and Joppocryptini - as spring-summer type. Clypeodromini, with only one species *Clypeodromus thyridialis* has a limited period of flying at the end of summer and dominates in August. Representatives of all groups with the highest number of spring-summer (15) and summer (24) species were recorded among the species of Cratichneumonina. The same results concern the representatives of the subtribe Ichneumonina, though the ratio of species number of spring-summer (24) and summer (11) groups is inverse, which is correlated with biological peculiarities of Ichneumoninae hibernating on as imaginal stages. The maximum number of Protichneumonini species (7) occurs among the species of a summer group. It should be noted that in spite of the fact that the species of the spring-summer-autumn group make only 9.7 % of all the number of the recorded species, they occupy a leading rank by abundance and include the most part of abundance species.

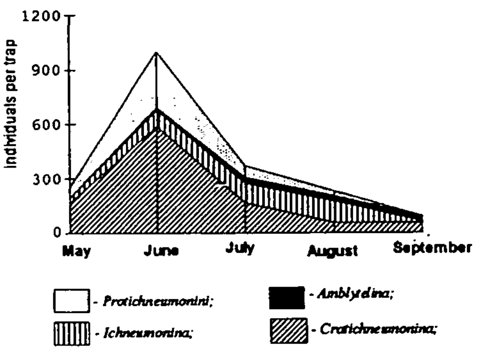

Fig. 5: Seasonal dynamics of Ichneumoninae St.

Dominance structure

One of the tasks of this investigation was the estimation of dominance structure fitness for the characterisation of the community of a concrete group as an example.

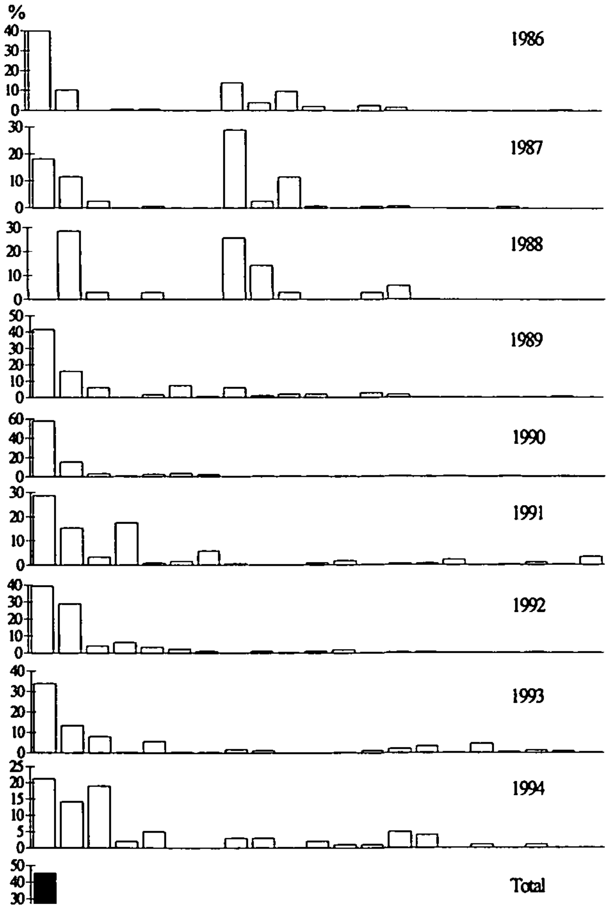

Fig. 6: Dominance structure in different years; 1 -*Cratichneumon viator*, 2 - *Coelichneumon nigerrimus*, 3 - *Coelichneumon haemorrhoidalis*, 4 - *Cratichneumon sicarius*, 5 - *Coelichneumon sinister*, 6 - *Barichneumon praeceptor*, 7 - *Cratichneumon armillatops*, 8 - *Spilichneumon celenae*, 9 - *Coelichneumon multicolor*, 10 - *Barichneumon sexalbatus*, 11 - *Melanichneumon melanarius*, 12 - *Virgichneumon dumeticola*, 13 - *Coelichneumon fasciatus*, 14 - *Ichneumon latrator*, 15 - *Ichneumon minutorius*, 16 - *Coelichneumon nobilis*, 17 - *Cratichneumon culex*, 18 - *Anisobas platystylus*, 19 - *Ichneumon simulans*, 20 - *Vulgichneumon suavis*, 21 - *Cratichneumon versator*

Figure 6 presents the summarized data about the dominance structure of the group representatives. Leading rank in dominance structure, on the basis of long term data: *Cratichneumon viator, Coelichneumon nigerrimus* and *C. haemorrhoidalis*. *Cratichneumon viator* occupied the first rank in dominance structure during 7 seasons.

Coelichneumon nigerrimus kept the second rank during 5 seasons and only once it occupied the first rank. *Coelichneumon haemorrhoidalis* - the third in the dominance structure kept its rank during three seasons and only in one season it occupied the second rank. The position of other species is variable because dominance structure per year is less stable. Thus, the dominance structure of Ichneumoninae St. cannot be considered as sufficiently stable in relation to the yearly index of a community state. Correlation coefficients between total dominance structure and dominance structures in separate years fluctuated between 0.27 and 0.98 in some years. Minimum indices of the coefficients were recorded in the years with minimum abundance of Ichneumoninae and on the contrary maximum indices - in the years with maximum abundance. Within 5 among 9 field season a coefficient of correlation between summary structure and structure in the separate seasons exceeded 0.9. Another situation was observed in the dominance structure fluctuation at the Ichneumonidae subfamilies level (see above). Quantitative ratio among different subfamilies was stable enough during the whole period of observations. The dominant species mainly determined long term fluctuations of Ichneumoninae St. abundance. Alignment of dominance structure was different in different years. In the years with maximum abundance of ichneumon flies dominant species led considerably in the total dominance structure.

Spatial distribution of species

To find out the species typical for raised bog conditions, investigations were directed on the spatial distribution of Ichneumoninae St. taking into account the heterogeneity of the ecosystem. The traps were placed on sites along the ecotone, on the border of the bog massive, on cutting, along a profile through the bog in the direction to the centre and near the bog's lake (fig. 7). Accordingly all collected species could be

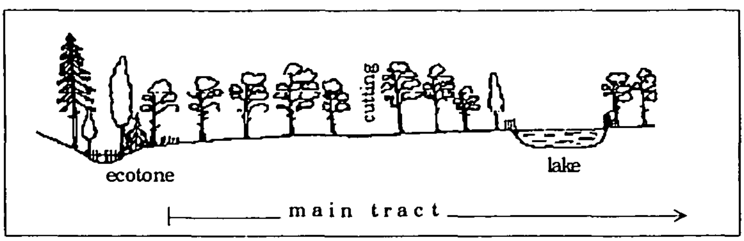

Fig. 7: Profile of a raised bog

seperated into three groups: 1 - species registered only on the border sites, 2 - species registered only in the central part of the massive and 3 - species registered everywhere along the whole profile of the raised bog. 19 species registered in the first group are typically presented by single individuals with ranks in the dominance structure below 32. They can be considered as the species not typical for raised bog ecosystem. They were marked by one asterisk in the table. Relating to number, they

are only 0.7 % of all the collected Ichneumoninae St., 32% of all the species and only 1.5 % of the total number are the species peculiar to the central part of the massive only (marked in the table by two asterisks). Like the species of the previous group all of them are rather small in number and do not occupy the ranks above 50 in the total dominance structure. The third group is the most numerous according to the number of species and also to individuals. It's species are registered everywhere along the raised bog profile. It includes all mass species registered on the raised bog. This group of species can be devided into three sub-groups: a - species, the number of which were sharply reduced by moving away from the border to the centre (marked by three asterisks), b - species, the number of which is higher in the central parts of the massive (marked by four asterisks) and c - species, the distribution of which is more or less even (not marked by asterisk). The first subgroup includes 22 species only three of which - *Cratichneumon sicarius, C. armillatops* and *Coelichneumon nobilis* are mass species and occupy rank 4, 7 and 16 in a total dominance structure of Ichneumoninae accordingly. Species of Ichneumoninae St., the abundance of which increases in the direction to the central part of the massive constitute the most numerous group according to the number of individuals. It includes 23 species, which form 86 % of the total number of Ichneumoninae collected during the whole period of observation. The overwhelming majority of most mass species in the total dominance structure is represented by: *Cratichneumon viator, Coelichneumon nigerrimus, C. haemorrhoidalis, C. sinister, Barichneumon praeceptor, Spilichneumon celenae, Coelichneumon multicolor, Barichneumon sexalbatus, Melanichneumon melanarius, Coelichneumon fasciatus, Ichneumon latrator, Anisobas platystylus, Cratichneumon versator* (fig. 6).

Thus, when determining a group of species more typical for raised bog ecosystem it is possible to exclude species with small numbers typical for border sites (*), and also those mass species the abundance of which is sharply reduced in the direction to the centre of the massive (***). The reduction of species with small numbers can be accidental. It should be noted, that this conclusion was made on the basis of all data within long term. Thus, only 102 of 134 species recorded in total are typical for theraised bog ecosystem.

In 1992 special investigation were carried out to ascertain the conformities of natural laws for ichneumon flies distribution and factors determining them. Several Malaise traps were placed taking into account the bog's high heterogeneity (fig. 7). Parts of central part of the massive were distinguished by the density of stand and a shrub layer having different density of coverage. We did not reveal any correlation between those differences and the number of ichneumon flies caught. On bog sites around the lake *Melanichneumon melanarius* and *Coelichneumon multicolor* were concentrated in large numbers on umbelliferous flowers, especially on *Cicuta virosa* L.

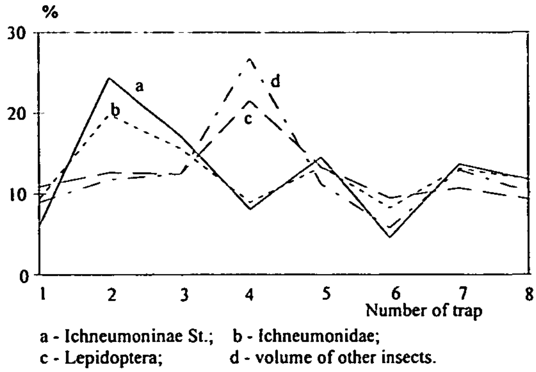

Fig. 8: Distribution of insects by raised bog's profile

Figure 8 shows the quantitative distribution of Ichneumonidae, Lepidoptera and other insects (curve d reflects the percentage distribution of the samples' volumes after Ichneumonidae and Lepidoptera were removed from them) of all traps at the profile. One can see, that most active flying insects are concentrated on a cutting (N 4), i.e. on the most open site. But it does not apply to Ichneumoninae St. and Ichneumonidae in general, the distribution of which more likely depence on the distribution of the hosts at the preimaginal stage of development.

Long term dynamics of Ichneumoninae

One of the main tasks of these investigations was an attempt to estimate long term dynamics of parasite insects in field conditions and the reasons causing them. As investigations show there is no development of the raised bogs on the territory of Beresina Biosphere National Reserve at present and they are in an equilibrium state (KUDIN, SMOLIAK 1983). That is why raised bog is one of the most stable communities and the influence of the successional changes reduces to a minimum. Thus, one can hope to extimate the most reliable factors influencing the long term dynamics of Ichneumoninae.

Since 1986 until now registrations of Ichneumonidae abundance have been contacted with the help of Malaise traps, which have been under operation during the whole period of all field-seasons. In spite of the facts, that in different years different numbers of traps were used depending upon concrete tasks of the year (up to 8 traps) it should be noted that quantitative differences among separate traps at the same year were considerably less than among separate traps in different years. Therefore, it is possible to consider that the curve of ichneumon flies long term dynamics reflects many years processes quite objectively. Long term dynamics of Ichneumoninae as a whole and definite systematic and biological units grouped by such parameters as relation to hibernation, parasitism on specific groups of the hosts, depositing eggs into the host larvae or pupa and so on were also observed.

The resulting curves were compared with long term oscillations of practically all climatic indices, both average annual and seasonal, with periods of maximal activity,

with Ichneumoninae as a whole and with separated biological groups also. Besides that curves of long term dynamics of different subfamilies of Lepidoptera and correlating groups of Ichneumoninae were compared. Altogether, for determining the factors influencing the long term dynamics of both Ichneumoninae as a whole and their biological groups, the long term dynamic of 62 climatic and biotic indices were analysed.

Weather conditions during summer season

The weather conditions during summer season did not radically and naturally influence the long term dynamics of Ichneumoninae. Correlation coefficients between average summer temperatures and precipitation and long term dynamics of ichneumon flies were 0.48 and 0.28 accordingly and were not significant. In 1988 and 1989 when maximum precipitation and higher air temperatures were registered, a minimum intensity of Ichneumoninae flying was recorded. Figure 9 shows the dynamics of deviation of total seasonal precipitation and average summer temperatures from the average long term indices (norm). One can see, that the peak of Ichneumoninae abundance in 1990 was preceded by years with a sharp deviation of sums of precipitation and average temperatures from the norm, showing an increase. Thus, years preceding the peak of abundance were rainy and warm, while in the year of the abundance's peak the temperature and precipitation were close to the average long term indices (norm). The summer season of 1994 was hot and dry, especially in June when the intensity of Ichneumoninae flying was at a maximum but the activity of ichneumon flies was at minimum. The same is revealed in comparison with long term dynamics of Ichneumonina activity and climatic indices per month.

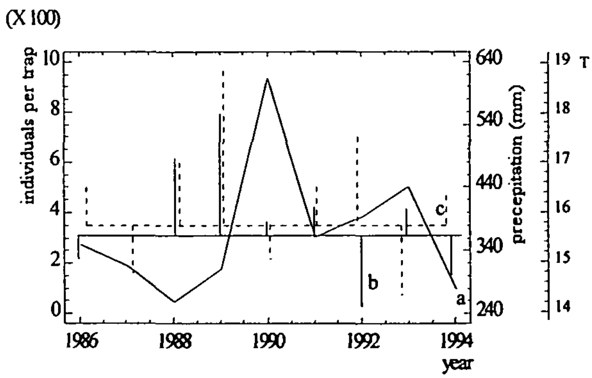

Fig. 9: Long term dynamics of Ichneumoninae St. (a) and deviation of climate indices from the norm during summer season; b - precipitation, c - temperature

Influence of climatic factors in winter and spring periods

When considering long term dynamics of climatic indices it was established that there is correlation between long term fluctuations of climate in winter and spring and fluctuation of Ichneumoninae abundance. An increase of ichneumon flies' activity during summer season was observed when winter periods became warmer. It reached a maximum in 1990 when the number of days with temperatures above zero and average winter temperature were highest (fig. 10). Comparing curves reflecting long term dynamics of biological groups of Ichneumoninae it was established that the best correlation is observed between long term dynamics of Ichneumoninae hibernating as preimaginal stages of development and the long term oscillation of the climatic indices in winter and spring periods. The lowest percentage of Ichneumoninae hibernating as preimaginal stages occurs in years with the coldest winters and late springs (fig. 11). Correlation coefficients between long term dynamics of average minimum temperatures and the number of days with frost during spring period and the dynamics of the ratio of Ichneumoninae hibernating at different stages of development are 0.89 and 0.85 accordingly.

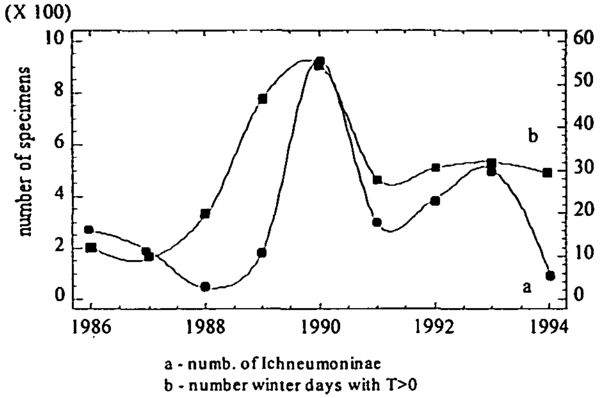

Fig. 10: Dependence of long term dynamics of Ichneumoninae St. on winter conditions

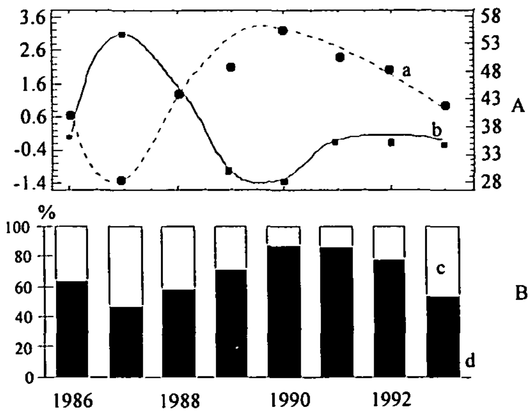

Fig. 11: Average climate indices' influence (A) on the ratio of the hibernating (c) and nonhibernating (d) Ichneumoninae St. (B); a - average minimum temperature of the year, b - number of days in spring with temperature less 0°C

As it was mentioned, the main part of Ichneumoninae St. numbers consisted of the representatives of the Cratichneumonina subtribe and the Protichneumonini tribe constituted 77 % of the total quantity of the collected individuals. They mainly determined their long term dynamics. Representatives of these groups hibernate as preimaginal stages of development. It is supposed that the

revealed dependencies are determined by a weak adaptation of these groups to unfavourable winter conditions.

The attempt to reveal naturally determined correlations between long term dynamics of the hosts and groups of Ichneumoninae connected with them did not show significant results. Maybe this can be explained by the fact that Malaise traps are not useful for the study of dynamics of Lepidoptera (see "Spatial distribution of species"). Nevertheless in one case a three years delay in the dynamics of Noctuidae could be correlated with representatives of Ichneumoninae.

Conclusion

Raised bog (Pinetum sphagnosum) is one of the richest ecosystems considering the numbers of Ichneumoninae Stenopneusticae species. During 9-years of observation 134 species have been discovered. The number of species registered in a concrete season depends on a long term fluctuation of abundance. Full determination of species' composition was obtained only after eight years of continuous observation. The highest number of species and abundance of Ichneumoninae St. were registered in June, first of all by species of the tribe Protichneumonini and the subtribe Cratichneumonina. The highest number of Ichneumonina subtribe species was recorded in May. Representatives of subtribe Amblytelina reach their maximum of abundance at the end of summer period. The most numerous species in the total dominance structure were *Cratichneumon viator, Coelichneumon nigerrimus* and *C. haemorrhoidalis*. Despite a practically complete absence of successional changes the dominance structure varied considerably between years. Thus, it was not a sufficiently stable index of a community state. Studying of spacial distribution showed that only 102 of total 134 species recorded were typical for raised bog ecosystem. Investigations of long term dynamics of Ichneumoninae St. and the factors determining them showed that long term dynamics were determined to a considerable degree by the climate conditions of winter and spring periods. Abundance of Ichneumoninae increases when winter periods become warmer and decreases in the years with cold winters and late spring. Long term dynamics of Ichneumoninae St. as a whole was determined, first of all, by fluctuations of the abundance of Ichneumoninae hibernating as preimaginal stages of development which are apparently less adopted to unfavourable winter conditions.

Acknowledgments

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Adress of the author: Dr. Alexandr M. TERESHKIN,
Institute of Zoology, Byelorussian Ac. of Sci.,
Scoriny 27, 220733 Minsk 72, Republik Belarus.

Table 1. Species composition and phenology of Ichneumoninae Stenopneusticae of the raised bog; (* - distribution; see in the text)

No	Species	Months					Total
		May	June	July	August	Sept.	
1	2	3	4	5	6	7	8
	Platylabini	3	10	5	2		20
1.	*Apaeleticus mesostictus* GRAV.	1			1		2
2.	*Cyclolabus nigricollis* WESM. *	1			1		2
3.	*Hypomecus quadriannulatus* GRAV. ***		7	1	1		9
4.	*Platylabus iridipennis* GRAV. **	1					1
5.	*Platylabus histrio* WESM.*			2			2
6.	*Platylabus odiosus* PERK.*			1			1
7.	*Platylabus opaculus* THOMS. **		1				1
8.	*Platylabus rufiventris* WESM.*			1			1
9.	*Platylabus zagoriensis* HEINRICH		2				2
	Clypeodromini			1	10		11
10.	*Clypeodromus thyridialis* TERESHKIN **			1	10		11
	Listrodromini	3	32	3			38
11.	*Anisobas platystylus* THOMS. ****	3	31	3			37
12.	*Listrodromus nycthemerus* GRAV. **		1				1
	Joppocryptini						
13.	*Pseudoplatylabus violentus* GRAV.	1		2	2		6
	Ichneumonini						
	Cratichneumonina	785	2584	669	215	30	4283
14.	*Aoplus castaneus* GRAV.	1	2	2			5
15.	*Aoplus defraudator* WESM. *			1			1
16.	*Aoplus lugubris* BERTH.		2	1			3
17.	*Aoplus praestigator* WESM. *		1	1			2
18.	*Aoplus pulchricornis* GRAV. *		2	2			4
19.	*Aoplus ruficeps* GRAV.	1	5				6
20.	*Aoplus torpidus* WESM. *		1				1
21.	*Barichneumon bilunulatus* GRAV.	2	1	1			4
22.	*Barichneumon perversus* KRIECHB.	4	5	3		1	13
23.	*Barichneumon praeceptor* THUNB. ****	24	104	48	5	1	182
24.	*Barichneumon sedulus* GRAV. **			1			1
25.	*Barichneumon sexalbatus* GRAV. ****	6	59	5	4		74
26.	*Barichneumon* sp. **		2	2	4	2	10
27.	*Cratichneumon armillatops* RASN. ***	13	98	8	8		127
28.	*Cratichneumon culex* MÜLL. ***		37	3	2		42
29.	*Cratichneumon dissimilis* GRAV.	1	5				6
30.	*Cratichneumon fabricator* F. **		1				1
31.	*Cratichneumon foersteri* WESM. ***	1	11	3	1		16
32.	*Cratichneumon palliditarsis* THOMS. **			1			1
33.	*Cratichneumon punctifrons* HOLMGR. **	2	2				4
34.	*Cratichneumon rufifrons* GRAV. **		2				2
35.	*Cratichneumon sicarius* GRAV. ***		171	82	4	1	258

1	2	3	4	5	6	7	8
36.	*Cratichneumon tenebrosus* WESM. **		1	1			2
37.	*Cratichneumon versator* THUNB. ****		26		1		27
38.	*Cratichneumon viator* SCOPOLI ****	696	1882	405	138	18	3139
39.	*Crypteffigies albilarvatus* GRAV.	6	8				14
40.	*Eristicus clarigator* WESM. **		1				1
41.	*Eupalamus lacteator* GRAV. *		1	2			3
42.	*Eupalamus oscillator* WESM. *				1		1
43.	*Eupalamus wesmaeli* THOMS. **			5			5
44.	*Homotherus locutor* THUNB. ****	15	4				19
45.	*Homotherus varipes* GRAV. ***	1	12	2	2	1	18
46.	*Melanichneumon designatorius* L. **			2			2
47.	*Melanichneumon melanarius* WESM. ****		41	20	6		67
48.	*Platylabops virginalis* WESM. **	1	1		4	5	11
49.	*Rhadinodonta flaviger* WESM. ***	4	5	1	3		13
50.	*Rhadinodonta rufidens* WESM. **	2					2
51.	*Stenaoplus pictus* GRAV. ****	1	3	10	2		16
52.	*Stenobarichneumon basiglyptus* KRIECHB.		1	2	2		5
53.	*Virgichneumon digrammus* GRAV. **				1		1
54.	*Virgichneumon dumeticola* GRAV. ***	2	42	17	4	1	66
55.	*Virgichneumon faunus* GRAV.			5	2		7
56.	*Virgichneumon* sp.aff. *krapinensis* SCHMIED.		6	2	3		11
57.	*Virgichneumon* sp. ***	1	15	7	3		26
58.	*Vulgichneumon bimaculatus* SCHRANK ***		8	13	1		22
59.	*Vulgichneumon deceptor* GRAV.	1		3	6		10
60.	*Vulgichneumon saturatorius* L.		2		1		3
61.	*Vulgichneumon suavis* GRAV. ***		14	8	7		29
	Ichneumonina						
62.	*Chasmias lugens* GRAV.	1				1	2
63.	*Chasmias motatorius* F. ***	6	5	1	3		15
64.	*Exephanes occupator* GRAV. ***	14	1				15
65.	*Ichneumon albiger* WESM.	2	2				4
66.	*Ichneumon ? alpestriops* HEINRICH **		2	5			7
67.	*Ichneumon amphibolus* KRIECHB. ****	7	3	1			11
68.	*Ichneumon analis* WESM.	5			1		6
69.	*Ichneumon analisorius* HEINRICH. **	1		1	1		3
70.	*Ichneumon bellipes* WESM. **	3	1				4
71.	*Ichneumon confusor* GRAV.	2	3	1			6
72.	*Ichneumon connectens* ROMAN ****	4	7	7	2		20
73.	*Ichneumon croceipes* WESM.	2	2				4
74.	*Ichneumon didymus* GRAV. **	1		2	2		5
75.	*Ichneumon ? emancipatops* HEINRICH **	1					1
76.	*Ichneumon formosus* GRAV.	11	3	2		1	17
77.	*Ichneumon fulvicornis* GRAV.	2		1			3
78.	*Ichneumon gracilentus* WESM. ***	11	6	1			18
79.	*Ichneumon gracilicornis* WESM. **	2		1			3

1	2	3	4	5	6	7	8
80.	*Ichneumon hinzi* HEINRICH **	1					1
81.	*Ichneumon immisericors* TISCHB. **		2				2
82.	*Ichneumon ingratus* HELLEN	1	1				2
83.	*Ichneumon insidiosus* WESM.	1	3				4
84.	*Ichneumon languidus* WESM. **		3				3
85.	*Ichneumon latrator* F. ****	3	9	11	35	4	62
86.	*Ichneumon ligatorius* THUNB. **		2				2
87.	*Ichneumon melanobatus* GRAV. **	5	4	1	2		12
88.	*Ichneumon melanotis* HOLMGR. **	1					1
89.	*Ichneumon minutorius* DESV. ***	28	19	16	7		70
90.	*Ichneumon molitorius* L.	2	1				3
91.	*Ichneumon nebulosae* HINZ **				1		1
92.	*Ichneumon observandus* HEINRICH **	1					1
93.	*Ichneumon primatorius* FORST. **			1			1
94.	*Ichneumon quadrialbatus* GRAV. **	2					2
95.	*Ichneumon sculpturatus* HOLMGR. ****	7	10	2	1		20
96.	*Ichneumon silaceus* GRAV. **	7		1			8
97.	*Ichneumon simulans* TISCHB.	8	12	8	9		37
98.	*Ichneumon spurius* WESM. *				1		1
99.	*Ichneumon* sp. **	2			1		3
-	*Males Ichneumon* ****	14	296	433	531	10	1284
100.	*Patrocloides chalybeatus* GRAV. *	1					1
101.	*Stenichneumon culpator* SCHRANK			1	3	1	5
102.	*Syspasis alboguttatus* GRAV.		1	3			4
103.	*Syspasis eburnifrons* WESM. **			2	1		3
104.	*Syspasis tauma* HEINRICH **	3	1	4			8
105.	*Thyrateles camelinus* WESM. **		1	1			2
106.	*Ulesta perspicua* WESM. *	2					2
	Amblytelina	16	50	69	32	28	195
107.	*Achaius oratorius* F. ***	4	6	7	1		18
108.	*Diphyus palliatorius* GRAV. **	1					1
109.	*Diphyus raptorius* L.	1				1	2
110.	*Eutanyacra crispatoria* L. ****	4	4	2	3	2	15
111.	*Eutanyacra glaucatoria* F. ****		13	8	3		24
112.	*Hepiopelmus melanogaster* GMEL. *			2			2
113.	*Spilichneumon ammonius* GRAV. ****	1	11				12
114.	*Spilichneumon celenae* PERKINS ****	4	16	46	24	25	115
115.	*Spilichneumon johansoni* HOLMGR. **	1		1			2
116.	*Spilichneumon limnophilus* THOMS. *				1		1
117.	*Tricholabus strigatorius* GRAV. **			3			3
	Hoplismenina	2	2	1			8
118.	*Hoplismenus bispinatorius* THUNB. **	4	2	1			7
119.	*Hoplismenus pica* WESM. *	1					1
	Protichneumonini	257	1360	331	142	7	2097
120.	*Amblyjoppa proteus* CHRIST. ***			8	1		9

1	2	3	4	5	6	7	8
121.	*Coelichneumon cretatus* GRAV. **		1				1
122.	*Coelichneumon cyaniventris* WESM. *		14	2	2		18
123.	*Coelichneumon desinatorius* THUNB. **		1		4		5
124.	*Coelichneumon falsificus* GMEL. *		5			1	6
125.	*Coelichneumon fasciatus* WESM. ****	3	30	13	6		51
126.	*Coelichneumon haemorrhoidalis* GRAV. ****		36.9	17.1	0.6		
127.	*Coelichneumon leucocerus* GRAV.		2				2
128.	*Coelichneumon multicolor* GMEL. ****	1	62	16	2		81
129.	*Coelichneumon nigerrimus* STEPH. ****	237	898	139	77	2	1353
130.	*Coelichneumon nobilis* WESM. ***	2	33	9	1		45
131.	*Coelichneumon sinister* WESM. ****	14	113	40	31	2	200
132.	*Coelichneumon sugillatorius* L. ***		10	2			12
133.	*Protichneumon pisorius* L. ****			3	13	2	18
	Trogini				1		1
134.	*Callajoppa cirrogaster* SCHRANK *				1		1
	Total:	1234	4438	1589	1006	82	8349